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(54) Title of Invention

Interior material and production thereof

## SPECIFICATION

### PURPOSE:

To provide a foamed interior material having sharp uneven patterns identical to printing patterns formed thereto by mechanical embossing and excellent in design effect.

### CONSTRUCTION:

An interior material and its production method wherein printing patterns (2) are formed on the surface of a vinyl chloride type resin layer polymerized by a sodium alkylbenzene sulfonate type emulsifier containing a foaming agent and a plasticizer by using paint containing a foam suppressing agent compatible with the plasticizer; and the vinyl chloride type resin layer is heated and foamed (3) to form uneven patterns (a) and (b) identical to the printing patterns and stripe patterns (4) formed on the protruding pattern parts (b) by an embossing roll. In this case, the foam suppressing agent is benzotriazole.

### [Efficacy of the invention]

By this method, the interior material having sharp patterns identical to the printing patterns formed to the concave areas thereof by chemical embossing and having a sharp embossed design formed to the foamed layer of the convex areas thereof by the embossing roll and novel printing patterns with embossed design is obtained.

### [Scope of Claims]

#### [Claim 1]

An interior material wherein printing patterns are formed on the surface of a vinyl chloride type resin layer polymerized by a sodium alkylbenzene sulfonate type emulsifier and containing a foaming agent and a plasticizer by using paint containing a foam suppressing agent compatible with the plasticizer; and the vinyl chloride type resin layer is heated and foamed to form uneven patterns identical to the said printing patterns, and stripe patterns are formed on the protruding pattern parts by an embossing roll.

#### [Claim 2]

An interior material as defined in claim 1, characterized in that the foam suppressing agent is benzotriazole.

#### [Claim 3]

A production method for an interior material wherein printing patterns are formed on the surface of a vinyl chloride type resin layer polymerized by a sodium alkylbenzene sulfonate type emulsifier and containing a foaming agent and a plasticizer by using paint containing a foam suppressing agent compatible with the plasticizer; and the vinyl chloride type resin layer is heated and foamed to form uneven patterns identical to the said printing patterns, and stripe patterns are formed on the protruding pattern parts by an embossing roll.

### [Description of the Invention]

[0001]

The present invention relates to the production method for an interior material used for wall coverings and ceilings, and more specifically, a foamed interior material having uneven patterns produced by a chemical emboss method.

[0002]

[Prior Art Technology]

Conventionally, the following two methods are known as methods to produce a foamed interior material having uneven patterns.

The first method is that the desired patterns are painted on the surface of an un-foamed vinyl chloride type resin layer containing a foaming agent by using paint containing a foam suppressing agent. Then, the vinyl chloride type resin layer is foamed to form uneven patterns on the non-painted areas while the painted areas are suppressed from foaming to produce identical uneven patterns to the original printing patterns.

The second method is that the desired patterns are painted on the surface of an un-foamed vinyl chloride type resin layer containing a foaming agent by using paint containing a foam accelerating agent. Then, the painted areas of the vinyl chloride type resin layer is foamed larger to produce uneven patterns than the non-painted areas to produce the identical uneven patterns to the original printing patterns.

These methods are so called conventional chemical embossing methods producing identical uneven patterns to the original printing patterns by shrinking or expanding the printing areas compared to the non-painted areas.

[0003]

Moreover, alternatively, a so called mechanical embossing method in which an un-foamed synthetic resin layer containing a foaming agent is superimposed on a base, then the said synthetic resin layer is heated and foamed to produce uneven patterns on the surface with a embossing roll is known.

[0004]

The advantage of a foamed interior material by a chemical embossing method is that the obtained uneven patterns are identical to the printing patterns, however the design of printing patterns available with this method are simple. More specifically, producing sharp and fine uneven patterns, and right angle patterns are impossible with this method. On the other hand, an interior material produced by a mechanical embossing method is capable of producing fine, sharp uneven patterns on the sheet surface with a specific type of an embossing roll. However, producing identical uneven patterns to the printing patterns has been mechanically quite difficult due to the sheet shrinkage.

[0005]

To solve the forgoing problems, there has been a proposal that combined both the chemical embossing method and the mechanical embossing method in Japanese Patent Publication No. Sho 61-20422, wherein the desired patterns are painted on the surface of an un-foamed vinyl chloride type resin layer containing a foaming agent by using paint containing a foam suppressing agent, then, the vinyl chloride type resin layer is heated and foamed followed by producing embossing design on the surface with an embossing roll. By this method, one can take advantages of both the chemical embossing method and the mechanical embossing method to some degree. However, the sharpness of the embossing design in the mechanically embossed areas is decreased as it is foamed after mechanical embossing. Moreover, the sharpness of the painting patterns in the areas painted with paint containing a forming suppressing agent is also decreased due to mechanical embossing.

[0006]

[Problems Overcome by the Invention]

To solve the foregoing problems, to maximize the synchronization of printing patterns and uneven patterns and the sharpness of the printing patterns of the chemical embossing method, moreover to produce the excellent uneven printing patterns with design effect, the present inventors carried out an extensive investigation. After printing with paint containing a foam suppressing agent on the surface of an un-foamed vinyl chloride type resin layer containing a foaming agent, the vinyl chloride type resin layer is heated and foamed to form identical uneven patterns with the printing patterns. Then, uneven stripe patterns were produced on the surface of the foamed layer with an embossing roll. However, this method brought about the problem that the lack of sharpness of the printing patterns on the recessed areas became evident since the foamed layer of the surrounding concave areas created by the printing patterns are twisted and overlap each other with the force of an embossing roll.

[0007]

Moreover, it is possible to overlay transparent films or sheets having different melting temperatures on the surface of a vinyl chloride type resin layer to clearly imprint and form the printed uneven stripe patterns with an embossing roll in the mechanical embossing step. Hence the thickness of the layer increases as transparent films or sheets are overlaid, and it is not favorable to use as a wall covering material or ceiling material as the material weights do not satisfy the frame-resistance standard.

[0008]

The objective of the present invention is to solve the foregoing problems and to provide a foamed interior material having identical uneven patterns with the printing patterns, and forming sharp, uneven stripe patterns thereto by mechanical embossing and excellent design effect.

[0009]

[Problem Resolution Means]

After extensive research to solve the foregoing problems, the inventors of the present invention found that a tangent line of the concave areas that suppresses foaming (a) and the surrounding foamed areas (b) at the curve inflexion point (p) of the vertical section, an acute

angle (t) between the surface of a base (1) and the parallel line (hereinafter referred to as tumble angle), and the types of a vinyl chloride type resin used (refer to FIG.1) are the significant factors for the successful production of a foamed interior material. More specifically, when a tumble angle (t) is greater than 40 degree and the surface of the foamed vinyl chloride type resin layer is imprinted by an embossing roll, the force in the rolling direction covers the printing patterns of a concave area (a) to a foamed layer (b) and transforms (c) (refer to FIG.3). Moreover, the inventors found that this transformation also depends on the type of vinyl chloride resin used.

[0010]

Generally, it is suitable to have a tumble angle of the said concave area having close to a right angle in order to produce sharp, uneven patterns (a), (b) on the chemical embossing method. Hence, the layer combined the trimellitic acid type foam suppressing agent and a vinyl chloride resin polymerized by a sodium alkyl sulfonate type emulsifier is used. However, with this combination which can produce favorable uneven patterns (a), (b) when only the chemical embossing method is used, the printing patterns in the concave area (a) is covered with the surrounding foamed layer (b) at the step of imprinting with an embossing roll thereafter.

[0011]

Hence, when the method to decrease the tumble angle (t) at the concave area to 40 degrees or smaller was sought, the inventors of the present invention found out that the tumble angle of the concave area greatly depended on the compatibility between a foam suppressing agent and the plasticizer used. More specifically, the foam suppressing agent easily transfers to the plasticizer in the vinyl chloride type resin when the foam suppressing agent and the plasticizer are compatible, and the foam suppressing agent does not transfer to the plasticizer when they are not compatible. Therefore, the inventors of the present invention attempted to adjust the angle by transferring the foam suppressing agent after the embossing.

[0012]

The foam suppressing agent in paint transfers slowly from the central part of the printing pattern areas with a concentration gradient when the foam suppressing agent which has compatibility with a plasticizer is used. Therefore, when it is foamed, it foams in the printing areas as a center with a gradual slope to minimize the tumble angle at the concave areas of 40 degrees or less.

[0013]

Moreover, even the tumble angle of the concave area is 40 degrees or less, when a vinyl chloride type resin layer polymerized by a sodium alkyl sulfate type emulsifier such as sodium lauryl sulfate conventionally used in the chemical embossing method, the printing patterns on the concave areas tend to be covered by the surrounding foamed areas at the time of imprinting the convex patterning areas with an embossing roll followed by foaming. After further investigation, the use of a vinyl chloride type resin polymerized by a sodium alkyl benzene sulfonate type emulsifier turned out to be suitable for this purpose as the concave areas are not covered by the surrounding foamed areas at the time of imprinting with an embossing roll.

[0014]

Therefore, the measure that the present invention took is to form the printing pattern on the surface of the vinyl chloride polymerized by a sodium alkyl benzene sulfonate type emulsifier containing a foaming agent and a plasticizer by using paint containing a foam suppressing agent compatible with the plasticizer. Then, the vinyl chloride type resin layer is heated and foamed to form uneven patterns which are identical to the printing patterns and embossing design formed on the convex pattern areas by an embossing roll, in order to provide an interior material. In this case, the foam suppressing agent is benzotriazole. As a production method, a vinyl chloride type resin paste containing the vinyl chloride type resin polymerized by the sodium alkyl benzene sulfonate type emulsifier, a foaming agent, and a plasticizer is painted on a base. The said paste was heated to gelatinize, and the printing patterns were formed thereon by using paint containing a foam suppressing agent compatible with the said plasticizer, then the said built-up body is heated and foamed to expand the uneven patterns which are identical to the printing pattern. Lastly, the embossing design is formed on the convex pattern areas of the said built-up body by using an embossing roll.

[0015]

[Effect]

By this method, the interior material having recessed patterns identical to the printing patterns and having sharp embossed design with novel printing patterns is obtained.

[0016]

[Embodiment]

An embodiment of the interior material in the present invention is described hereafter, with reference to the drawings. The interior material formed by the method wherein a vinyl chloride type resin paste containing the vinyl chloride type resin polymerized by the sodium alkyl benzene sulfonate type emulsifier, a foaming agent, and a plasticizer is painted on a base (1). The paste was heated to gelatinize and the printing patterns (2) formed on the surface by using paint containing a foam suppressing agent compatible with the plasticizer, then the built-up body is heated and foamed (3) to expand the uneven patterns (a), (b) which are identical to the printing pattern (2). Lastly, the embossing design (4) is formed on the convex pattern area (b) of the said built-up body by using an embossing roll.

[0017]

The term "foam suppressing agent" compatible with a plasticizer in the present invention refers to the agent dissolved to a plasticizer added in a vinyl chloride resin layer or a foam suppressing agent which is mixable when it is in an aqueous state.

For instance, the agent which dissolves or is mixable with a plasticizer in the following test is considered to be compatible and suitable for the present purpose.

(Method to test a chemical solubility to a plasticizer)

Mix 100g of a plasticizer (aqueous) and 1g of a foam suppressing agent (solid) in a beaker to

see if the agent dissolves in a plasticizer after 24h of stirring over a magnet stirrer. Moreover, in case that a foam suppressing agent is in an aqueous state, mix 100g of a plasticizer (liquid) and 1g of a foam suppressing agent (aqueous) in a beaker to see if they are mixable. Using the above methods one can determine whether a foam suppressing agent dissolved in a plasticizer is compatible with the plasticizer. The foam suppressing agents that are capable of dissolving or being mixed with a plasticizer transfer to the plasticizer are used appropriately for the purpose as it is compatible with the plasticizer.

[0018]

The kind of a plasticizer added to a vinyl chloride type resin in the present invention is a generally used plasticizer. For instance, besides di-2-ethylhexyl phthalate (DOP), phthalate ester type plasticizers including dioctyl phthalate (DnOP) and dibutyl phthalate (DBP), phosphate ester type plasticizers including tricresyl phosphate (TCP), di-2-ethylhexyl adipate, sebacic acid ester plasticizer, polyester type plasticizers are used. Moreover, as a secondary plasticizer, epoxy type plasticizers such as an epoxy soybean oil or chloride paraffin may also be used. The recommended amount of these plasticizers is within 20-80 parts by weight of the plasticizer to 100 parts by weight of a vinyl chloride type resin in order to get the sufficient strength of the vinyl chloride type resin, the transferability of the plasticizer and the bleed. These plasticizers may be used in combination.

[0019]

The term "foam suppressing agent" in the present invention refers to the substance that substantially suppresses the breakdown of a foaming agent at the melting temperature of the foaming agent in a vinyl chloride type resin, and the type of the foam suppressing agent depends on the kind of the foaming agent used.

[0020]

As a foaming agent added in the vinyl chloride type resin, a conventional foaming agent used in the foamed interior material made of a vinyl chloride type resin can be used. For instance, these foaming agents include azodicarbonamide (ADCA), dinitroso pentamethylene tetramine (DPT), azobisisobutyronitrile (AIBN), and 4,4'-Oxybisbenzenesulfonic acid dihydrazide (OBSH). Moreover, besides these foaming agents, a kicker to decrease the break down temperature of the foaming agents may be added to the vinyl chloride type resin before foaming. For instances, when ADCA is used as a foaming agent, zinc oxide, zinc soap, cadmium soap, lead soap can be used as a kicker to decrease the break down temperature of ADCA.

[0021]

The foam suppressing agent is effective only when it is used with a proper forming agent. Some of the foam suppressing agents are effective in decreasing the breakdown temperature of the foaming agent itself and others are effective in inhibiting the effect by a kicker. Thus, the selection of the agent has to be properly made. The foaming agent inhibiting the effect of a kicker prevents it from breaking down until it reaches the break down temperature of the original foaming agents by inhibiting the effect of the kicker and creates a foaming areas and non-foaming areas due to differences in the break down temperatures.



[0022]

When ADCA is used as a foaming agent and DOP is used as a plasticizer as well, favorable foam suppressing agents, more specifically agents having both a foam suppressive effect and compatibility with a plasticizer include the following solid substances at room temperature, such as benzotriazol, 2-benzothiazolethiol, maleic anhydride, and  $\text{cis}\Delta^4$  tetrahydrophthalic anhydride and a liquid substance such as acetyl acetone. Among them, benzotriazol is favorable in terms of its high foam suppressing effect and the transferability to DOP. This foam suppressing agent is used alone or combination with others. Besides the foam suppressing agents described above, any foam suppressing agent having compatibility with a plasticizer and having the foam suppressing effect can be used. The foam suppressing agents are generally mixed with paint before use.

[0023]

Printing paint used is usually in aqueous solution in which colorant or resin component are dissolved or dispersed. The foam suppressing agent is used after the concentration is adjusted and print painted in accordance with the type of agent added. Usually, the foam suppressing agent is used in a concentration of 5-30 parts by weight. Furthermore, as to the printing method on the vinyl chloride type resin layer, an arbitrary method such as gravure printing or rotary screen-printing is used. After the printing, the vinyl chloride resin layer is heated using an heating oven to dry solvent and water in paint at 50-240°C. However, in order to prevent the foam suppressing agent from transferring too much as time goes by, within 100 hours, 24-48h if possible after printing and drying to allow the foam suppressing agent to properly transfer to foam the tumble angle ( $\theta$ ) of the concave area with a gradual slope of 40 degrees or less. However, the tumble angles of the concave areas are expected to be within 10-40 degrees as the shapes of the printing patterns (2) of the concave part lose their sharpness when the angles are too small.

[0024]

The term "vinyl chloride type resin" collectively used in the present invention is intended to be vinyl chloride type resin into which various additives such as a plasticizer, a secondary plasticizer, a stabilizer, a filling, a surface surfactant, a fire retardant, a foaming agent, a coloring, a UV-absorbent, antioxidant, an anti-static agent, a processing aid are properly mixed. Furthermore, the term "vinyl chloride type resin" extends to vinyl chloride-vinyl acetate copolymer, copolymer with any other monomer copolymerizable therewith such as vinyl chloride-ethylene copolymer, a blend of vinyl chloride type resin and other heat plasticizer resin, and synthetic rubber.

[0025]

Moreover, the vinyl chloride resin used in the present invention is the vinyl chloride resin polymerized by a sodium alkylbenzene sulfonate type emulsifier to prevent the printing patterns of the concave areas from being covered with the surrounding foamed layer at the time of printing by an embossing roll after the chemical embossing step.

[0026]

Even in the chemical embossing step where the vinyl chloride resin polymerized by a sodium alkylsulfonate type emulsifier is generally used, when the tumble angles of the concave areas

is 40 degrees or less, the printing patterns of the concave areas come to lack sharpness, since the foaming layer around of the chemical embossing concave areas displaces in a rolling direction and covers the concave areas due to the force caused by applying a embossing roll.

[0027]

Thus, after further investigation to find a vinyl chloride resin that is more resistant to the foaming layer covering the concave areas, the best results were obtained from a vinyl chloride resin polymerized by a sodium alkylbenzene sulfonate type emulsifier. The effect does not depend on the amount of polymerization, and any kind of the vinyl chloride resin polymerized by a sodium alkylbenzene sulfonate type emulsifier usually used is favorable. In general, the best results are obtained from a vinyl chloride type resin polymerized by a sodium alkylbenzene sulfonate type emulsifier with a polymerization degree of 50-300. Moreover, an emulsifier having 8-16 carbons in the alkyl group is favorable for a sodium alkylbenzene sulfonate type emulsifier, such as a sodium dodecylbenzene sulfate.

[0028]

The base (1) used in the present invention is not limited to a specific kind. For instance, a textile fabric or non-textile made from fabric frame-resistant paper containing heat-resistant substances such as metal hydrate including aluminum hydroxide and magnesium hydroxide, non-inflammable paper, natural fiber, synthetic fiber, glass fiber can be used.

Furthermore, the recommended thickness of the base is thinner than 0.5mm due to reasons of fire safety in case these heavy bases are used for the wall covering and ceiling. Furthermore, considering the thickness of the vinyl chloride type resin layer overlay thereon, the use of a base with a thickness of 0.05-0.2mm is favorable.

[0029]

The build-up of the vinyl chloride type resin on the base (1) is done first by directly painting the vinyl chloride type resin paste on the base (1), then heating to gelatinize at 100-170°C, which is lower than the foaming temperature to build-up the vinyl chloride type resin thereon. Alternatively, this is achieved by painting the vinyl chloride type paste on a mold such a paper mold, then gelatinizing it to form a vinyl chloride type resin sheet. Lastly, the sheet is removed from the mold and overlaid on the base by using an adhesive, heat or heat lamination method.

[0030]

When the built-up body of the base and the vinyl chloride type resin are used as wall coverings and for the ceiling, there is a weight limitation in accordance with fire safe performance. For instance, when the second degree of fire safe performance is required for a vinyl wallpaper, the weight should be lighter than 400g/m<sup>2</sup>. Accordingly, a weight of a vinyl chloride type resin also has to be adjusted. When the weight of a frame resistant base is 70g/m<sup>2</sup>, then the weight of a vinyl chloride type resin should be less than 330g/m<sup>2</sup>. When the relative density of the vinyl chloride type resin is 1-2, the thickness of the vinyl chloride type resin layer becomes below 0.17-0.33mm. The thickness and weight of the vinyl chloride type resin layer is determined in terms of fire safe performance. However, the vinyl chloride type resin layer is usually made with a thickness of approximately 0.1-0.5mm. Furthermore, there is no

limitation in the width and length of the built-up body, however it is formed in a long length with a width of 800-1500mm and cut to an appropriate length according to the place of use.

[0031]

When the foaming scale of the vinyl chloride type resin layer is too low, the steps between the concave areas and the convex areas become too small for chemical embossing. On the other hand, when the foaming scale is too high, the vinyl chloride type resin foaming layer (3) collapses, and loses strength and elasticity. Thus foaming the resin with a foaming scale of 1.5-6 is favorable. With the present invention, after vinyl chloride type resin layer is foamed while the printing pattern areas (2) formed by a paint containing the foam suppressing agent are un-foamed, the resultant products are heated with a heater such as an infrared heater to soften or melt the surface, then the arbitrary embossed designs (4) are formed by an embossing roll on the convex patterns (b) of the vinyl chloride type foaming layer (3).

[0032]

The embossing roll is the metallic roll forming embossing design and having 200-100m in diameter and 1-2m in width. By passing the built-up body of the foamed vinyl chloride type resin layer (3) and the base (1) between the metallic embossing roll and a rubber roll, the embossing design (4) is printed on the surface of the vinyl chloride type resin layer. Mechanical embossing is performed either by placing a certain air separation between the embossing roll and the rubber roll to print or by pressing the embossing roll and the rubber roll without having an air separation between them. Moreover, a known processing agent may be painted to foam a coat on the surface of the vinyl chloride type resin layer to make it pollution-resistant with a thickness of approximately 1-30 $\mu$ m before or after embossing the embossing design (4) mechanically by using an embossing roll.

[0033]

Moreover, the type of stabilizer is not limited to a certain kinds, however the best results are obtained from the foaming stabilizer generally used for a vinyl chloride type resin. The zinc containing stabilizer such as calcium-zinc series, barium-zinc series, potassium-zinc series, zinc-sodium-potassium-barium complex stabilizer, and zinc-calcium-tin complex stabilizer give the favorable results depend on the combination with a foaming agent. Furthermore, the chemical compound may be added to adjust the breakdown temperature of a foaming agent, the size and the strength of the cell in a vinyl chloride type resin foaming body. However, the kind of compound is not limited to those compounds described.

[0034]

Next, the embodiment of the present invention and the comparative example are further described. Using the test described in [0017], the solubility and transferability to DOP was measured after the foam suppressive agent was mixed with DOP. The transferability to DOP was measured as follows. First, paint containing a foam suppressive agent with 10 parts by weight was prepared and used to print on the surface of vinyl chloride resin layer. After being dried for 24 hours, the presence of the foam suppressive agent on the surrounding printing areas was measured by using gas chromatography or liquid chromatography. It was judged to be "good" when the foam suppressive agent was detected. However, it should be noted that some of the agents can be used as a foam suppressive agents if the agent dissolves or is

mixable with other plasticizers, even if it does not dissolve or is mixable with DOP.

[0035]

Solubility and transferability test of DOP and various foam suppressing agents

Foam suppressing agent	Solubility	Transferability
Adipate	Poor	Poor
Phthalate	Poor	Poor
Maleic anhydride	Good	Good
C1sΔ4 tetrahydrophtalic anhydride	Good	Good
Trimellitic acid anhydride	Poor	Poor
Tetrachloro phthalate anhydride	Poor	Poor
Benzotriazol	Good	Good
2-benzothiazolethiol	Good	Good
Terephthaloyl chloride	Poor	Poor
Acetyl acetone (aqueous)	Good (mixable)	Good

[0036]

Next, the vinyl chloride resin past was prepared in accordance with the composition I (embodiment) and composition II (comparative example) listed below. The parts were coated using a paste coater for frame-resistant treatment. The paste was spread with a thickness of 0.16mm on the base made of frame-resistant paper with a thickness of 0.12mm before heating in a furnace oven at 160°C for 50 seconds to dry and gelatinize.

[0037]

[Table 1]

Composition	I	II
PVC*1	100	
PVC*2		100
DOP	45	45
Secondary plasticizer	5	5
Stabilizer(Ca-Zn series)	2	2
Azodicarbonamide	4	4
Kicker(ZnO)	1	1
Filling (CaCO <sub>3</sub> )	50	50
Cell adjuster	1	1
Colorant	15	15

Remarks:

\*1: a vinyl chloride type resin polymerized by a sodium dodecylbenzenesulfonate as an emulsifier

\*2: a vinyl chloride type resin polymerized by a sodium laurylsulfonate as an emulsifier

[0038]

Desired printings were photogravured using paint containing the following foam suppressing agent with 10 parts by weight on the surface of the vinyl chloride resin layer formed from the above mentioned composition I and II. After 24 hours, the vinyl chloride resin layer was heated in a furnace over at 210 °C for 60 seconds. Then, the vinyl chloride resin layer was foamed to express the chemical emboss uneven patterns.

- a. Benzotriazole
- b. Trimellitic acid anhydride
- c. Maleic anhydride
- d. c1sΔ4 tetrahydrophthalic anhydride

[0039]

Next, a mechanical emboss design was formed by imprinting the emboss design on the surface of the foamed convex patterns of the vinyl chloride resin layer using the metallic emboss roll engraved with reflected patterns after heating with a far infrared heater. The results for each built-up body are described below.

[0040]

[Table 2]

PVC layer	Composition I	Composition I	Composition I	Composition I
Foam suppressive agent	a	b	c	d
Tumble angle of the concave areas	30°	50°	25°	20°
Covered chemical embossing concave areas *1	Covered	none	covered	Covered
PVC layer	Composition II	Composition II	Composition II	Composition II
Foam suppressive agent	a	b	c	D
Tumble angle of the concave areas	35°	55°	35°	25°
Covered chemical embossing concave areas*1	None	none	none	None

(Remark):

The covering test of chemical concave areas was judged by the printing pattern of the chemical embossing concave areas is covered (covered) or not covered and maintaining sharp printing patterns (none) after imprinting with an embossing roll

[0041]

From the above results, the tumble angles of the recessed areas with 40degrees or less are formed with a gradual slope by using the foam suppressing agent compatible to a plasticizer. Moreover, compared to the vinyl chloride resin layer polymerized by a sodium alkyl sulfonate type emulsifier, the vinyl chloride resin layer polymerized by a sodium alkylbenzene sulfonate

type emulsifier does not covered by a surrounding foamed area (b) to transform (c) by the printing patterns (2) of the chemical embossing concave area (a) as described in FIG.3, and forms an interior material having quite sharp patterns (2) on the concave area (a) and having sharp embossing design as described in FIG.2.

[0042]

[Efficacy of the Invention]

The interior material of the present invention has the following characteristics:

a foam suppressing agent transfers into a plasticizer by using the substance as a foam suppressing agent that is compatible with the plasticizer to create gradual tumble angles at the recessing areas;  
the printing patterns of the concave areas do not get lost or the border areas between the concave area or the foaming area do not lose the sharpness as the foamed layer of the convex printing areas do not cover the chemical emboss concave area at the time of imprinting with an embossing roll by the use of the vinyl chloride resin layer polymerized by a sodium alkylbenzene sulfonate type emulsifier;  
the printing patterns of the concave area clearly remain; and  
the resultant interior material having sharp patterns formed on the concave areas by the chemical embossing thereof and having a sharp embossed design formed to the foamed layer of the convex areas thereof by the mechanical embossing and novel printing patterns with embossed design is obtained.

[0043]

Moreover, in case that benzotriazole is used as a foam suppressing agent, the painted chemical emboss recessed area remains almost un-foamed and properly transferred to a plasticiser as benzotriazole it is better in its foam suppressing effect compared to other foam suppressing agents. Thus, the tumble angles at the chemical emboss concave areas becomes smaller, which further results in an interior material having a much sharper printing patters of the concave areas.

[Brief Description of the Drawing]

[FIG.1] schematic view of a tumble angle at the recessed area

[FIG.2] enlarged sectional view of the embodiment

[FIG.3] enlarged sectional view of the comparative example

[Description of Numbers and Letters]

1: Base

2: Printing pattern

3: Vinyl chloride resin foamed layer

a: Foamed concave area

b: Foamed convex area

c: Embossing design

[FIG.1]

[FIG.2]

[FIG.3]

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## INTERIOR MATERIAL AND PRODUCTION THEREOF

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### Abstract

**PURPOSE:** To provide a foamed interior material having sharp uneven patterns synchronizing to printing patterns formed thereto by mechanical embossing and excellent in design effect.

**CONSTITUTION:** Printing patterns 2 are formed on the surface of a vinyl chloride resin layer polymerized by a sodium alkylbenzenesulfonate type emulsifier and containing a foaming agent and a plasticizer by using paint containing a foaming suppressing agent compatible with the plasticizer and the vinyl chloride resin layer is heated and foamed 3 to form uneven patterns (a), (b) synchronizing to the printing patterns and stripe patterns 4 are formed on the protruding pattern parts (b) by an embossing roll to provide an interior material. In this case, the foaming suppressing agent is benzotriazole. By this method, the interior material having sharp patterns synchronizing to the printing patterns formed to the recessed parts thereof by mechanical embossing and having a sharp embossed design formed to the foamed layer of the protruding parts thereof by the embossing roll and novel printing patterns and embossed design is obtained.

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Interior patterned material for walls, ceilings etc. - by pattern  
printing vinyl chloride resin surface layer and foaming to form  
convex-concave pattern

Patent Assignee: LONSEAL CORP (LONS )

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Abstract (Basic): JP 8244060 A

An interior material is prepd. by printing in a pattern the surface  
of a layer of vinyl chloride type resin produced by polymerisation in  
the presence of a Na alkylbenzene sulphonate type emulsifier, contg. a  
foaming agent and a plasticiser added thereto, with a coating material  
contg. a foaming inhibitor having an affinity to the plasticiser, and  
heating to foam so a concave convex pattern in harmony with the print  
pattern is formed, and forming an emboss pattern in the convex pattern  
portion with an emboss roll. Also claimed is prodn. where paste of the  
vinyl chloride type resin is coated onto a base (1), and heated to be  
gelled. With the coating material, the print pattern (2) is formed on  
the surface. The laminate is heated to be foamed (3). The emboss  
pattern (4) is formed.

USE - The interior material is useful for walls, ceilings, etc.

ADVANTAGE - The print pattern (2) in the concave portions (a) can  
be kept in the distinct state. The interior material has a good novel  
pattern.

Fig. 0/3

Title Terms: INTERIOR; PATTERN; MATERIAL; WALL; CEILING; PATTERN; PRINT;  
VINYL; CHLORIDE; RESIN; SURFACE; LAYER; FOAM; FORM; CONVEX; CONCAVE;  
PATTERN

Derwent Class: A14; A32; A93; P73

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B32B-027/00; B32B-027/30; B32B-033/00

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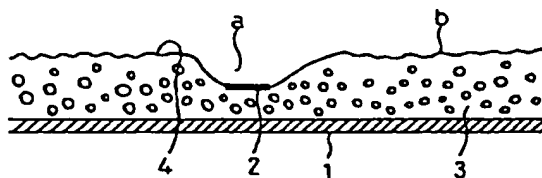
(54)【発明の名称】 内装材及びその製造方法

(57)【要約】

【目的】 本発明は印刷模様と同調した凹凸模様を有し、かつメカニカルエンボスによる鮮明な凹凸模様を形成した意匠性に優れた発泡内装材を提供する。

【構成】 アルキルベンゼンスルホン酸ナトリウム系の乳化剤により重合されかつ発泡剤及び可塑剤が添加された塩化ビニル系樹脂層の表面に、該可塑剤と親和性のある発泡抑制剤を含有する塗料で印刷模様2を形成し、その後加熱発泡3して該印刷模様と同調した凹凸模様a、bとし、その表面にエンボスロールで凸模様部bに絞模様4を形成してなる内装材を提供すると共に、発泡抑制剤がベンゾトリアゾールであること及びその製造方法である。

【効果】 凹部にはケミカルエンボスによる印刷模様と同調した鮮明な模様を有しつつ、凸部の発泡層にはエンボスロールによるシャープな絞意匠が形成され、従来ない新規な印刷模様、絞意匠を持つ内装材となる。



## 【特許請求の範囲】

【請求項1】 アルキルベンゼンスルホン酸ナトリウム系の乳化剤により重合されかつ発泡剤及び可塑剤が添加された塩化ビニル系樹脂層の表面に、該可塑剤と親和性のある発泡抑制剤を含有する塗料で印刷模様を形成し、その後加熱発泡して該印刷模様と同調した凹凸模様とし、その表面にエンボスロールで凸模様部に絞模様を形成してなることを特徴とする内装材。

【請求項2】 発泡抑制剤がベンゾトリアゾールであることを特徴とする請求項1に記載の内装材。

【請求項3】 アルキルベンゼンスルホン酸ナトリウム系の乳化剤により重合された塩化ビニル系樹脂及び発泡剤、可塑剤を含有する塩化ビニル系樹脂ペーストを基材に塗工し、該ペーストを加熱によりゲル化させた後、その表面に、該可塑剤と親和性のある発泡抑制剤を含有する塗料で印刷模様を形成し、その後、該積層体を加熱発泡せしめて印刷模様と同調した凹凸模様を現出させ、しかる後、エンボスロールで該積層体の凸模様部に絞模様を形成することを特徴とする内装材の製造方法。

## 【発明の詳細な説明】

## 【0001】

【産業上の利用分野】 本発明は壁装材・天井材等の内装材の製造方法に関し、更に詳しくはケミカルエンボス法により凹凸模様を施した発泡内装材に関する。

## 【0002】

【従来の技術】 従来、凹凸模様を有する発泡内装材の製造方法としては、発泡剤が含有された未発泡塩化ビニル系樹脂層の表面に発泡抑制剤を含有した塗料で所望の模様に印刷し、これを発泡させて抑制剤含有塗料が塗工されていない部分を発泡させ、塗工部分の発泡を抑制することにより印刷柄と一致した凹凸模様を現出させる方法、又は発泡剤が含有された未発泡塩化ビニル系樹脂層の表面に発泡促進剤を混入した塗料で所望の模様に印刷し、これを発泡させて促進剤混入塗料が塗工された部分を周囲の部分よりも大きく発泡させることにより印刷柄と一致した凹凸模様を現出させる方法が知られている。これらは所謂ケミカルエンボス法とよばれ、印刷した部分のみを他の部分よりも窪ませたり又は突出させたりすることで凹凸模様を印刷柄と一致させることができることから、従来から広く行なわれている手段である。

【0003】 また、他の方法として発泡剤含有の未発泡合成樹脂層を基材上に積層し、該合成樹脂層を加熱し発泡させ、その表面にエンボスロールで凹凸模様を形成する所謂メカニカルエンボス法が知られている。

【0004】 前記ケミカルエンボス法による発泡内装材は、印刷模様と凹凸柄とを一致させることができる長所があるものの、得られる模様は単調であり、特に鋭角な細かい凹凸柄や直角模様を現出させることは不可能であった。また、メカニカルエンボス法による発泡内装材は、エンボスロールの形状によりシート面への繊細でシ

ャープな凹凸表現は可能であるが、印刷模様と凹凸柄とを機械的に一致させることは、シートの伸縮等によって非常に困難な技術であった。

【0005】 これらを解決するために、ケミカルエンボス法とメカニカルエンボス法を組み合わせる方法が特公昭61-20422号公報に記載されている。これは発泡剤が混入された未発泡塩化ビニル系樹脂層の表面に、発泡抑制剤が混入された塗料で任意の模様を印刷し、その表面にエンボスロールにて凹凸絞模様を形成した後、これを加熱して発泡させるものである。この方法ではケミカルエンボスとメカニカルエンボスの両方の特徴をある程度取り合わせたものを製造できるが、メカニカルエンボス後に発泡させるのでメカニカルエンボス部の凹凸絞模様の鮮明さは減少し、更に発泡抑制剤が混入された塗料の印刷部分においてもメカニカルエンボスされているため印刷模様の鮮明さが失われるものであった。

## 【0006】

【発明が解決しようとする課題】 このような問題を解決し、ケミカルエンボスの印刷模様と凹凸模様の同調性、印刷模様の鮮明さを活かしながら、更に意匠性の高い凹凸印刷模様を創出する方法として、本発明者は発泡剤を混入した未発泡の塩化ビニル系樹脂層表面に発泡抑制剤を混入した塗料で印刷した後、これを加熱発泡して印刷模様と同調した凹凸模様を形成せしめ、その後エンボスロールにて発泡層の表面に凹凸絞模様を形成することを試みたが、印刷模様による凹部周囲の発泡層がエンボスロールの押圧によってよじれて被さってしまい、凹部の印刷模様が失われ不鮮明になってしまう問題が生じた。

【0007】 また、メカニカルエンボス鮮明に型押しするために塩化ビニル系樹脂の表面に熔融温度の異なる透明なフィルム又はシートを積層し、エンボスロールによって型押し凹凸絞模様を形成することが考えられるが、そのためには透明フィルム又はシートの厚さを厚くする必要がある。しかし透明フィルム又はシートを積層すると、壁装材・天井材として使用するには、難燃基準をこえる重量となるという問題も生じる。

【0008】 本発明はこれらの問題点を解決し、印刷模様と同調した凹凸模様を有し、かつメカニカルエンボスによる鮮明な凹凸絞模様を形成した意匠性に優れた発泡内装材を提供することを目的とする。

## 【0009】

【課題を解決するための手段】 本発明者は前記課題を解決すべく研究した結果、発泡が抑制された凹部aと周囲の発泡部分bとの垂直断面における曲線の変曲点pでの接線と、基材1面との平行線との間の鋭角側の角度（以下抑制部の落ち込み角度という）tと、使用する塩化ビニル樹脂の種類に大きく影響されることを見出した（図1参照）。即ち、抑制部の落ち込み角度tが40度よりも大きいと、その後のエンボスロールにて発泡塩化ビニ

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ル樹脂層の表面を押圧することにより、エンボスロールの流れ方向の圧力により凹部aの印刷模様が発泡層bによって被さって、変形cしてしまうという現象を見出した(図3参照)。また、これは塩化ビニル樹脂の種類にも影響されることも判明した。

【0010】一般に、ケミカルエンボスによる凹凸模様a、bは前記の抑制部落ち込み角度が90度に近いほど好ましいものであり、そのためにトリメット酸系の発泡抑制剤と、アルキル硫酸ナトリウム系の乳化剤で重合された塩化ビニル樹脂を組み合わせたもので行われている。しかしながらこの様な組み合わせでは、ケミカルエンボスのみの凹凸模様a、bとしては好ましくても、その後エンボスロールにて型押しを行うと凹部aの印刷模様が周囲の発泡層bによって被さってしまうものであった。

【0011】そのため抑制部の落ち込み角度 $\theta$ が40度以下とするための手段を研究したところ、抑制部の落ち込み角度 $\theta$ は使用する発泡抑制剤と可塑剤との親和性に大きく依存することを見出した。即ち発泡抑制剤が塩化ビニル樹脂に添加されている可塑剤に親和性があると可塑剤に移行しやすく、親和性がないと可塑剤へ移行しにくく、発泡抑制剤を塗布後へ移行させることによって、角度を調整することを考えた。

【0012】可塑剤に親和性のある発泡抑制剤を用いると、塗料中の発泡抑制剤が印刷模様部を中心に徐々に抑制剤濃度が薄くなるように濃度勾配をもって移行し、そのためその後発泡させると印刷部分を中心に緩やかなスロープで発泡し抑制部の落ち込み角度を40度以下にすることができることが判明した。

【0013】また、発泡後、その凸模様部をエンボスロールにて型押しを行うと、抑制部の落ち込み角度が40度以下でもケミカルエンボスにおいて通常使用されるラウリル硫酸ナトリウム等のアルキル硫酸ナトリウム系の乳化剤によって重合された塩化ビニル樹脂を用いると、凹部の印刷模様が周囲の発泡層によって被さってしまう傾向にあり、このため塩化ビニル樹脂の検討を行った結果、アルキルベンゼンスルホン酸ナトリウム系の乳化剤によって重合された塩化ビニル樹脂を用いると、エンボスロールによって型押ししても凹部の印刷模様が周囲の発泡層によって被さらないことを見出した。

【0014】そのために本発明が講じた手段は、アルキルベンゼンスルホン酸ナトリウム系の乳化剤により重合されかつ発泡剤及び可塑剤が添加された塩化ビニル系樹脂層の表面に、該可塑剤と親和性のある発泡抑制剤を含有する塗料で印刷模様を形成し、その後加熱発泡して該印刷模様と同調した凹凸模様とし、その表面にエンボスロールで凸模様部に絞模様を形成してなる内装材を提供すると共に、発泡抑制剤がベンゾトリアゾールであること及びその製造方法としてアルキルベンゼンスルホン酸ナトリウム系の乳化剤により重合された塩化ビニル

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樹脂及び発泡剤、可塑剤を含有する塩化ビニル系樹脂ペーストを基材に塗工し、該ペーストを加熱によりゲル化させ、その表面に、該可塑剤と親和性のある発泡抑制剤を含有する塗料で印刷模様を形成し、その後、該積層体を加熱発泡せしめて印刷模様と同調した凹凸模様を現出させ、しかる後、エンボスロールで該積層体の凸模様部に絞模様を形成することである。

【0015】

【作用】本発明により印刷模様と同調した抑制模様と、シャープな凹凸絞模様とを兼ね備えた従来にない新規な意匠の内装材を提供することができる。

【0016】

【実施例】本発明の内装材の実施の一例を図面に基づいて説明すると、内装材はアルキルベンゼンスルホン酸ナトリウム系の乳化剤により重合された塩化ビニル樹脂及び発泡剤、可塑剤を含有する塩化ビニル系樹脂ペーストを基材1に塗工し、該ペーストを加熱によりゲル化させ、その表面に、該可塑剤と親和性のある発泡抑制剤を含有する塗料で印刷模様2を形成し、その後、該積層体を加熱して発泡3せしめて印刷模様2と同調した凹凸模様a、bを現出させ、しかる後、エンボスロールで該積層体の凸模様部bに絞模様4を形成したものである。

【0017】本発明の可塑剤に親和性のある発泡抑制剤とは塩化ビニル樹脂層に添加された可塑剤に溶解するか、又は液状の場合には相溶する発泡抑制剤であって、例えば次のような試験方法で溶解又は相溶するものが可塑剤に親和性のあるものとして好ましく使用できる。

(可塑剤への溶解試験方法) ビーカーに可塑剤(液状) 100g、発泡抑制剤(固体) 1gを混合し、マグネットスターラーで24時間攪拌し溶解するかどうかを観る。また、液状の発泡抑制剤の場合は、ビーカーに可塑剤(液状) 100g、発泡抑制剤(液状) 1gを混合し、相溶するかどうかを観る。上記試験方法において可塑剤に溶解する発泡抑制剤は可塑剤に親和性があると判断することができ、この試験方法において可塑剤に溶解又は相溶する発泡抑制剤は可塑剤へ移行し、可塑剤に親和性があるものとして好ましく使用できる。

【0018】本発明の塩化ビニル系樹脂に添加される可塑剤としては通常使用されている周知の可塑剤を使用することができる。例えば、ジ・2-エチルヘキシルフタレート(DOP)の他に、ジオクチルフタレート(DnOP)、ジブチルフタレート(DBP)等のフタル酸エステル系可塑剤、トリクレジルホスフェート(TCP)等のリン酸エステル系可塑剤、ジ・2-エチルヘキシルアジベート、セバチン酸エステル可塑剤、ポリエステル系可塑剤等が挙げられ、更に二次可塑剤としてエポキシ化大豆油等のエポキシ系可塑剤や塩素化パラフィン等を添加して使用することも可能である。これら可塑剤の添加料は、塩化ビニル系樹脂100重量部に対して可塑剤を20~80重量部の範囲で添加することが塩化ビニル

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系樹脂層の硬さや可塑剤の移行、ブリード等の面から好ましい。これらの可塑剤は数種併用して使用することも可能である。

【0019】本発明において発泡抑制剤は塩化ビニル系樹脂に添加される発泡剤が分解する温度において発泡剤の分解を実質的に抑制する働きをもたらす物質のことをいい、使用する発泡剤の種類などによってそれぞれ特定される。

【0020】塩化ビニル系樹脂に添加する発泡剤は、塩化ビニル系樹脂製の発泡内装材に使用している公知の発泡剤を使用することができ、例えばアゾジカルボンアミド(ADCA)、ジニトロソペンタメチレンテトラミン(DPT)、アゾビスイソプロチロニトリル(AIBN)、4,4'-オキシビスベンゼスルホニヒドログリッド(OBSH)等を使用することができる。また、これら発泡剤のほかに、発泡剤の分解温度を低下させる働きを持つキッカーを塩化ビニル系樹脂に添加して発泡させることも可能である。例えば発泡剤がADCAの場合は酸化亜鉛、亜鉛石鹸、カドミウム石鹸、鉛石鹸がキッカーとなりADCAの分解温度を低下させることができる。

【0021】発泡抑制剤は使用する発泡剤に適した物質を選定して始めて効果があり、また、発泡剤の分解温度そのものを上げる作用を有する発泡抑制剤やキッカーの働きを妨げる作用を有する発泡抑制剤等があり、これらを適宜選定して使用する。キッカーの働きを妨げる発泡抑制剤はキッカーの働きを妨げることにより発泡剤の元々の分解温度に達しないと分解しないようにし、その分解温度の差によって発泡する部分と発泡しない部分とを形成するものである。

【0022】発泡剤としてADCA、可塑剤としてDOPを主体としたものを使用する場合において好ましい発泡抑制剤、即ち発泡抑制効果があり、かつ可塑剤と親和性の良い発泡抑制剤としてはベンゾトリアゾール、2-ベンゾチアゾールチオール、無水マレイン酸、無水cis-Δ4テトラヒドロフタル酸などの常温で固体状の物質の他、アセチルアセトンなどの液状物質なども使用できる。なかでもベンゾトリアゾールは発泡抑制効果に優れ、かつDOPに適度に移行し、とりわけ好ましい。この発泡抑制剤は単体でも複数種混合して使用しても良

く、更に上記の物質に限定されず、可塑剤に親和性があり、かつ発泡抑制効果があればどのような発泡抑制剤を使用しても良い。発泡抑制剤は印刷塗料に混合して使用するのが一般的である。

【0023】印刷塗料は着色剤・樹脂成分を溶剤などに溶解または分散させた液状のものを通常使用し、発泡抑制剤はその種類によって濃度を適宜調整して印刷塗料に添加して使用する。通常は5~30重量%の濃度で使用する。また、塩化ビニル樹脂層への印刷はグラビア印刷、ロータリースクリーン印刷等の任意の印刷方法で行

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うことができる。印刷後は塗料の溶剤又は水分をオープン等によって50~150℃で加熱して揮発させる。印刷後、発泡剤が分解する温度150~240℃で発泡させるが、印刷後あまり時間をおきすぎると発泡抑制剤が移行し過ぎて印刷部分の抑制効果が減少することもあるため、印刷・乾燥後100時間以内、特に好ましくは24~48時間後に発泡させると発泡抑制剤が適度に可塑剤へ移行し、抑制部の落ち込み角度が40度以下の緩やかスロープとなる。抑制部の落ち込み角度tはあまり緩やかすぎても凹部aの印刷模様2の輪郭が不鮮明になるため、10~40度の範囲とすることが好ましい。

【0024】本発明でいう塩化ビニル系樹脂とは、塩化ビニル樹脂に可塑剤及び2次可塑剤・安定剤・充填剤・減粘剤・難燃剤・発泡剤・着色剤・紫外線吸収剤・酸化防止剤・帯電防止剤・加工助剤等の各種添加剤を適宜添加したもののほか、酢酸ビニル-塩化ビニル共重合体、エチレン-塩化ビニル共重合体等の他のモノマーとの共重合体、或いは塩化ビニル樹脂に他の熱可塑性樹脂、合成ゴムなどをブレンドしたものを総称していう。

【0025】また、本発明で使用する塩化ビニル樹脂は、ケミカルエンボス後のエンボスロールによる型押し工程において凹部の印刷模様が周囲の発泡層によって被さってしまわないようにするために、アルキルベンゼンスルホン酸ナトリウム系の乳化剤を用いて重合した塩化ビニル樹脂を用いる。

【0026】ケミカルエンボスにおいて一般に使用されているアルキル硫酸ナトリウム系の乳化剤によって重合された塩化ビニル樹脂では抑制部の落ち込み角度が40度以下であってもエンボスロールを通過させるとケミカルエンボス凹部の周囲の発泡層が流れ方向によじれて凹部へと被さってしまい、凹部の印刷模様が不鮮明になってしまう。

【0027】このため、エンボスロールの押圧によっても発泡層が凹部へ被さりにくい塩化ビニル樹脂を検討した結果、アルキルベンゼンスルホン酸ナトリウム系の乳化剤を用いて重合された塩化ビニル樹脂を使用するとよいことが判明した。この塩化ビニル樹脂の重合度は特に限定されず、一般に使用されているものであればどのような重合度のものでも良く、通常は重合度500~3000の範囲のものが好ましく使用できる。また、アルキルベンゼンスルホン酸ナトリウム系の乳化剤としては、アルキル基の炭素数が8~16の範囲のものが好ましく使用出来、例えばドデシルベンゼンスルホン酸ナトリウムが挙げられる。

【0028】本発明で用いる基材1は特に限定はされず、例えば水酸化アルミニウム・水酸化マグネシウム等の金属水和物等の難燃物質が添加された難燃紙・不燃紙等の紙、天然繊維・化学繊維・ガラス繊維等の繊維からなる織布又は不織布等が挙げられる。また、これらの基材は重すぎると壁装・天井材の防火性能上問題があるた

め、好ましくは0.5mm以下とすることが良く、その上に積層される塩化ビニル系樹脂層の厚みを考慮すると0.05~0.2mmとすることがとりわけ好ましい。

【0029】基材1への塩化ビニル系樹脂層の積層は、基材1上に直接塩化ビニル系樹脂製ペーストを塗工し、発泡温度以下の100~170℃で加熱してゲル化して塩化ビニル系樹脂層を積層するか、或いは離型紙などの離型体に塩化ビニル系樹脂製ペーストを塗工し、ゲル化させシート状に形成し、その塩化ビニル樹脂シートを離型体から剥離して接着剤や熱や熱ラミネート法などにより基材1に積層する方法などによって行なわれる。

【0030】基材及び塩化ビニル系樹脂層の積層体は、壁装材、天井材として使用する場合は防火性能によって重量等の制限があり、例えばビニル壁紙の2級の防火性能が要求される場合は400g/m<sup>2</sup>以下の重量とすることが要求されるため、塩化ビニル系樹脂層の重量もその範囲内になるように基材に積層する。難燃紙製の基材の重量が70g/m<sup>2</sup>の場合は塩化ビニル系樹脂層の重量を330g/m<sup>2</sup>以下とする。塩化ビニル系樹脂の比重を1~2とすると塩化ビニル系樹脂層は0.17~0.33mm以下の厚さとなる。塩化ビニル系樹脂層の厚さや重量はこのような防火性能上で決定されるが、一般的には0.1~0.5mm程度の厚さで形成されることが多い。また、積層体の幅、長さとも特に制限はなうが、一般的には800~1500mmの幅の長尺状に形成され、使用する場所によって長さを適宜裁断して使用する。

【0031】塩化ビニル系樹脂層の発泡倍率はあまり低くてもケミカルエンボスの凹凸段差がなくなり、高すぎると塩化ビニル系樹脂発泡層3がへたったり、強度・弾性力等がなくなるため、好ましくは1.5~6倍の範囲で発泡させるのが良い。本発明においては発泡抑制剤が添加された塗料で形成された印刷模様2部分を残して塩化ビニル系樹脂層を発泡させた後、これを赤外ヒーター等で加熱して表面を軟化又は熔融させ、エンボスロールにて凸模様部bの塩化ビニル系樹脂発泡層3に任意の凹凸模様の型押し成形する。

【0032】エンボスロールは直径200~1000mm

(DOPと各種発泡抑制剤の溶解・相溶性試験の結果)

発泡抑制剤	溶解性	移行性
アジピン酸	溶解しない	移行しない
フタル酸	溶解しない	移行しない
無水マレイン酸	溶解する	移行する
無水cisΔ4テトラヒドロフタル酸	溶解する	移行する
無水トリメット酸	溶解しない	移行しない
無水テトラクロロフタル酸	溶解しない	移行しない
ベンゾトリアゾール	溶解する	移行する
2-ベンゾチアゾールチオール	溶解する	移行する
塩化テレフタロイル	溶解しない	移行しない
アセチルアセトン(液状)	溶解(相溶)する	移行する

m、幅1~2mの金属製のロールに凹凸模様が形成されたもので、この金属製エンボスロールとゴムロールとの間に発泡後の塩化ビニル系樹脂層3と基材1とからなる積層体を通過させることにより、塩化ビニル系樹脂発泡層3の表面に凹凸模様が4が付与される。エンボスロールとゴムロールとの間には間隙を適宜とって型押しするか又は間隙をとらずにエンボスロールとゴムロールとを密着させて押圧して型押しする方法によってメカニカルエンボスを行う。また、エンボスロールにて機械的に模様4を形成した後或いは型押し前に、耐汚染性等を付与するために公知の処理剤を1~30μm程度の厚さで塩化ビニル樹脂層の表面に塗工し、皮膜を形成することも可能である。

【0033】また、安定剤においても特に限定はされないが、通常塩化ビニル系樹脂の発泡用安定剤と使用されているものが特に好ましく、このような安定剤としては例えばカルシウム-亜鉛系、バリウム-亜鉛系、カリウム-亜鉛系、亜鉛-ナトリウム-カリウム-バリウム複合安定剤、亜鉛-カルシウム-錫複合安定剤等の含亜鉛安定剤が発泡剤との組み合わせによって好ましく使用でき、更に発泡剤の分解温度や塩化ビニル系樹脂発泡体のセルの大きさや強度等を調整するための化合物が安定剤に混入されたものでも良いが、これらに限定されるものではない。

【0034】次に本発明の実施例と比較例を更に具体的に説明する。前記0017で説明した試験方法にて、発泡抑制剤をDOPに混入し、溶解性を調べると共にDOPへの移行性を観た。DOPへの移行性は発泡抑制剤を10重量%含有する塗料を作成し、塩化ビニル樹脂層の表面に、この塗料で印刷し、乾燥させ24時間後の印刷部分周囲の発泡抑制剤の有無をガスクロマトグラフィー又は液体クロマトグラフィーによって測定し、発泡抑制剤が検出されたものを移行すると判断した。ただし、DOPと溶解・相溶しない発泡抑制剤であっても、他の可塑剤と溶解・相溶するものであれば本発明の発泡抑制剤として使用することが出来るものである。

【0035】

【0036】次に、下記に記載の配合①（実施例）と配合②（比較例）により塩化ビニル樹脂ペーストを作製し、これをペーストコーターによって離熱処理を施した厚さ0.12mmの離熱紙からなる基材上に、それぞれ\*

\*厚さ0.16mmに塗工し、160℃に設定された加熱炉で50秒間加熱し乾燥ゲル化させた。

【0037】

【表1】

配 合	①	②
PVC（注1）	100	
PVC（注2）		100
DOP	45	45
二次可塑剤	5	5
安定剤（Ca-Zn系）	2	2
アゾジカルボンアミド	4	4
キッカー（ZnO）	1	1
充填材（CaCO <sub>3</sub> ）	50	50
セル調整剤	1	1
着色剤	15	15

（注1）乳化剤としてドデシルベンゼンスルホン酸ナトリウムを用いて重合した塩化ビニル樹脂

（注2）乳化剤としてラウリル硫酸ナトリウムを用いて重合した塩化ビニル樹脂

【0038】前記の配合①及び②から形成された塩化ビニル樹脂層の表面に、下記の発泡抑制剤を10重量%混合させた塗料で任意の模様をグラビア印刷した。24時間放置後、210℃に設定した加熱炉で60秒間加熱し、塩化ビニル樹脂層を発泡させケミカルエンボスの凹凸模様を現出させた。

- a. ベンゾトリアゾール
- b. 無水トリメリット酸
- c. 無水マレイン酸

d. 無水cisΔ4テトラヒドロフタル酸

【0039】次に、反射柄が彫刻されている金属製のエンボスロールにて、発泡された凸模様部の塩化ビニル樹脂層表面を遠赤外線ヒーターで加熱してから絞模様を型押しして、機械的な絞模様を形成した。それぞれの積層体についての試験結果を下記に示す。

【0040】

【表2】

PVC層	配合①	配合①	配合①	配合①
発泡抑制剤	a	b	c	d
抑制部落ち込み角度	30度	50度	25度	20度
ケミカル凹部被り性(注1)	○	×	○	○
PVC層	配合②	配合②	配合②	配合②
発泡抑制剤	a	b	c	d
抑制部落ち込み角度	35度	55度	35度	25度
ケミカル凹部被り性(注1)	×	×	×	×

(注1) : ケミカル凹部被り性はエンボスロールにて型押し後、ケミカルエンボス凹部印刷模様が周囲の発泡層によって被さらず、印刷模様が鮮明に残っているものを○、被ってしまったものを×とした。

【0041】以上の結果より、可塑剤と親和性のある発泡抑制剤を使用することにより、抑制部の落ち込み角度 $\theta$ が40度以下のスロープ状となり、かつ、アルキルベンゼンスルホン酸ナトリウム系の乳化剤によって重合された塩化ビニル樹脂層を用いたものは、アルキル硫酸ナトリウム系の乳化剤によって重合された塩化ビニル樹脂に比較して、図3のようにケミカルエンボスによる凹部aの印刷模様2に周囲の発泡層bが変形cして被さってしまうこともなく、図2に示すように凹部aの印刷模様2が非常に鮮明で、型押し紋模様4も鮮明なものであ

った。

【0042】

【発明の効果】本発明の内装材は発泡抑制剤として可塑剤と親和性のある物質を用いることにより、発泡抑制剤が可塑剤中へ移行し、ケミカルエンボスの抑制部の落ち込み角度が緩やかとなり、併せてアルキルベンゼンスルホン酸ナトリウム系の乳化剤を用いて重合された塩化ビニル樹脂を使用することにより、エンボスロールの型押し工程時に凸模様部の発泡層がケミカルエンボス凹部に被さって凹部の印刷模様が失われてしまったり、凹部

と発泡層との境界部が不鮮明になることもなく、凹部の印刷模様はより一層鮮明な状態で保持され、得られる内装材はケミカルエンボスによる凹部の鮮明な印刷模様と凸模様部の発泡層のメカニカルエンボスによる紋意匠とを兼ね備えた従来にない新規な模様を有するものとなる。

【0043】また、発泡抑制剤としてベンゾトリアゾールを用いた場合は、他の発泡抑制剤と比較して発泡抑制効果が大きいので、その塗布部のケミカルエンボス凹部はほとんど発泡せず印刷模様が鮮明に残り、且つ可塑剤へ適度に移行するため、ケミカルエンボスの抑制部の落ち込み角度が緩やかになり、得られる内装材は凹部の印刷模様がより一層鮮明なものとなる。

【図面の簡単な説明】

【図1】 抑制部の落ち込み角度の説明図

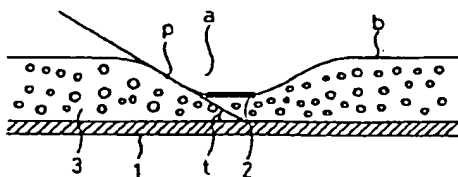
【図2】 実施例の拡大断面図

【図3】 比較例の拡大断面図

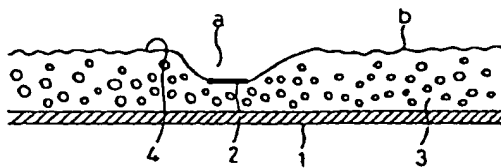
【符号の説明】

1 : 基材、2 : 印刷模様、3 : 塩化ビニル樹脂発泡層、  
a : 発泡凹部、b : 発泡凸部、4 : 紋模様、

【図1】

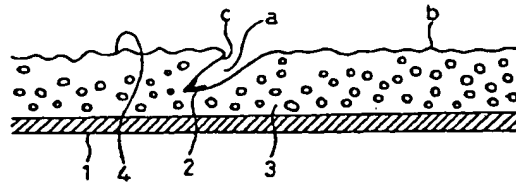


【図2】





【図3】




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(54) Name of Invention

Interior Material and its manufacturing process.

(57) Summary

**Purpose /** This invention provides foaming interior materials which have uneven patterns synchronized with printed patterns, and are good for designing clear uneven patterns by mechanical embossment.

**Composition /** Making print pattern(2) on the surface of vinyl chloride resin which was polymerized by an alkyl-benzene sulfonic acid sodium emulsified, and was added with foaming materials and reversible reaction materials, by paint contains foaming restraint materials which dissolve with applied reversible reaction materials. Then makes uneven patterns (a, b) synchronized with applied print patterns by heat-foaming (3), and provides interior materials making crested patterns (4) on convex patterns (b) by embossment. In mean time, the foaming restraint materials are benzotriazole and its manufacturing process.

**Results/** By having synchronized clear patterns and print patterns by chemical embossment on the concave part, and by making sharp crested patterns by embossment on the convex part of foaming stratum, this will be brand-new interior materials have new print patterns and crested designs.

**Area of patent request**

**(Request clause 1)**

The interior material which is characterized by the manufacturing process of; making print pattern on the surface of vinyl chloride resin which was polymerized by an alkyl-benzene sulfonic acid sodium emulsified, and was added with foaming materials and reversible reaction materials, by paint contains foaming restraint materials which dissolve with applied reversible reaction materials. Then it makes uneven patterns synchronized with applied print patterns by heat foaming, and makes crested patterns on convex patterns by embossment.

**(Request clause 2)**

The interior materials, are written in (request clause 1), which are characterized by that the foaming restraint materials is benzotriazole.

**(Request clause 3)**

The manufacturing process of the interior material which is made by; paint by using vinyl chloride resin which was polymerized by an alkyl-benzene surfon acid sodium emulsified, and vinyl chloride resin paste which contains foaming materials and reversible reaction materials. After gelled the paste by heat, making print pattern on the surface by paint contains foaming restraint materials, which dissolve with applied reversible reaction materials. Then making uneven patterns synchronized with print patterns by heat-foaming stratum, and makes crested patterns on convex patterns of stratum by embossrole.

Explanation of invention/

(0001/ Field of usage in the industry)

This invention is related with the manufacturing process of interior material like paint materials and ceiling materials. Therefore, this is about foaming interior materials with uneven patterns by chemical embossment.

(0002/ conventional technique)

There were two conventional manufacturing processes for foaming interior materials with uneven patterns.

One: Printing by paint with foaming restraint materials on the surface of unfoaming vinyl chloride resin stratum with foaming materials, then foams the part where restraint materials are not applied, and by restraining foaming, to make uneven patterns which are synchronized with prints.

Two: Printing by paint with foaming acceleration materials on the surface of unfoaming vinyl chloride resin stratum with foaming materials, then foams the part where acceleration materials are applied, and by accelerating foaming, to make uneven patterns which are synchronized with prints.

These are so-called Chemical Embossment, which synchronized uneven patterns and print designs by controlling printed part with materials.

(0003)

There is another way. It is so-called mechanical Embossment. Accumulating unfoaming synthetic resin stratum contains foaming materials on base materials, heat and make foam with the synthetic resin stratum, and make uneven patterns by embossrole.

(0004)

The foaming interior materials by chemical embossment have advantage to synchronize print patterns and uneven patterns, but the design is very simple; it is impossible to make a sharp uneven design and a right-angel design. Also, the foaming interior materials by mechanical embossment can have a sharp uneven patterns on surface by the form of embossrole, but it is truly difficult to synthesize print patterns and uneven design because of expand and contract of seat.

(0005)

To solve these disadvantages, there is the method which combined chemical embossment and mechanical embossment on the patent number 81-20422. This is to print a certain patterns on the surface of unfoaming vinyl chloride resin stratum contains foaming materials by paint with foaming restraint materials, then heat and make them foam after made uneven patterns by embossrole. This method has the character of both mechanical embossment and chemical embossment, but loses a little sharpness of mechanical embossment part and prints part where foaming restrain materials are used because of mechanical embossment.

(0006)

(The point this invention trying to solve)

To solve the problems above, and to make use of advantage of chemical embossment(synchronization of print patterns and uneven pattern, sharpness of print) and create good design for uneven print patterns, the inventors tried to create uneven crested patterns on the surface of synchronized stratum by embossrole after printed by paint contains foaming restraint materials on

unfoaming vinyl chloride resin stratum contains foaming materials, and heated, created uneven patterns synchronized with printed patterns. But, printed patterns on the concave part were lost and faded because foaming stratum was pressed by embossrole.

(0007)

There might be another way to create uneven crested patterns by embossrole after accumulating different clear films or sheets on the surface of vinyl chloride resin for clear mechanical embossment. For that, need thick clear films or sheets. That might make a problem, which will be too heavy for wall materials or ceiling materials.

(0008)

The invention will solve the problems above, and to make use of advantage of chemical embossment (synchronization of print patterns and uneven pattern, sharpness of print) and create good design for uneven print patterns.

(0009)

(The way to solve the problems)

To solve the problems, the inventors found out that there are big influence from the degree ( $t$ : fall in degree of restrained area) between the contact line, which is for the point (P) of curved line at vertical section foam restrained concave part (a) and around foamed area (b), and the sharp side of between base material surface and parallel lines, and also reflected what kind of material it uses for vinyl chloride resin (figure 1). Therefore, if the fall in degree of restraint area( $t$ ) is larger than 40 degrees, the print patterns at concave part (a) will be changed by pressing the surface of vinyl chloride resin with embossrole, and by having conflict between print patterns of concave part(a) and foam stratum(b).

(0010)

In general, the more the fall in degree of restraint part is close to 90 degrees, the better uneven patterns by chemical embossment will be. For that, it is done by trimet acid foaming restraint material and vinyl chloride resin polymerized by

alkyl sulfuric acid sodium emulsified. It is good for uneven patterns (a, b) only by chemical embossment; however, there is the conflict between foaming stratum (b) and print patterns of concave part (a) by embossrole.

(0011)

We found out that the fall-in-degree of restraint area really depends on the affinity of foaming restraint material and plasticity material after we studied the way to keep the fall-in- degree under 40 degrees. Therefore, if there is the affinity in the plasticity material in vinyl chloride resin of foaming restraint material, it will be easy to be the plasticity material. If not, it is hard to be the plasticity material, so that to adjust the degree by moving foaming restraint material after applied.

(0012)

It became clear that if we apply foaming restraint materials which has affinity to plasticity material, the applied foaming restraint materials slowly move with full degree slope to lighten the restraint materials around print patterns, and it foams with gentle slope around print patterns, makes the fall-in-degree of restraint part under 40 degrees.

(0013)

Also, even if the fall-in-degree of restrain material is less than 40 degrees, if we uses vinyl chloride resin polymerized by alkyl sulfuric acid sodium emulsified on chemical embossment as usual, the print patterns of concave part will be covered by foaming stratum after foaming and applying embossrole around convex patterns. We examined the vinyl chloride resin, and found out that if we uses vinyl chloride resin polymerized by alkyl benzene surfon acid sodium emulsified, the foam stratum doesn't cover the print patterns of concave area even if embossroled.

(0014)

Therefore, the method the invention tried was;

Creating print patterns by paint contains plasticity material and foaming restraint material with affinity on the vinyl chloride resin, with foaming restraint material and plasticity material applied, polymerized by alkyl benzene sulfon acid sodium emulsified.

Heating, foaming and synchronize uneven patterns and the print patterns, and provides interior material by creating crested patterns on convex part by emboss roll on the surface. Also, foaming restraint material must be benzotriazol.

Making the vinyl chloride resin paste, with foaming restraint material and plasticity material applied, polymerized by alkyl benzene sulfon acid sodium emulsified, to the base, then paint. And make the paste gelled by heating.

After creating print patterns by paint contains foaming restraint material with affinity and plasticity material on the surface, create uneven patterns, which synchronized, with print patterns by heating and foaming the accumulated stratum.

Then create the crested patterns on the convex part of accumulated stratum by emboss roll.

(0015)

(Function)

These invention supplies the new design interior material has both restraint patterns synchronized with print patterns and sharp uneven patterns.

(0016)

(Example)

The explanation about the invention based on the figures;

This interior material is made by: Using the vinyl chloride resin polymerized by alkyl benzene sulfon acid sodium emulsified, and vinyl chloride resin paste with foaming restraint material and plasticity material, as the base (1) and paint.



Heating the paste and makes it gelled, creating print patterns (2) by paint contains foaming restraint material with affinity and plasticity material on the surface.

After that, creating uneven patterns (a,b) which synchronized with print pattern (2) by heating and foaming(3) the accumulated stratum.

Then create the crested pattern (4) on the convex part (b) of accumulated stratum by emboss roll.

(0017)

The foaming restraint material with affinity to plasticity material in the invention is either dissolving into plasticity material in vinyl chloride resin or the foaming restraint material dissolves if it is requested. For instance, it is good to use as plasticity material with affinity that something dissolves, as exams show below.

(How to exam to solve into plasticity material)

To observe if they dissolve after mixing up 100g plasticity material (requested) and 1g foaming restraint material (solid) in a breaker and stirring for 24 hours by a magnet stirrer. If you got foaming restraint material, mix 1g of it with 100g plasticity material (requested) in a breaker, and observe to dissolve each other. If foaming restraint material dissolve, plasticity material will have affinity. This means that the foaming restraint material, which dissolves into plasticity material, moves to plasticity and it is good to use as plasticity material with affinity.

(0018)

It is no problems to use conventional plasticity material for adding to vinyl chloride resin in the invention. For instance, all ze 2-ethyl hekysyl ftarate(DOP), Ftat acid ester plasticity material such as Zeokthl ftarate(DnOP), diphthylftarate(DBP), Phosphoric acid ester plasticity material such as Trikrezyllhosfate(TCP), Ze 2-ethylhekysilagipate, sevachyn acid ester plasticity material, Polyester plasticity material etc, and moreover as the second plasticity

material, Ebokisi material such as Ebokisi soybean oil or Palafin chlorode are no problems to add. All these materials are preferred to mix as vinyl chloride resin(100) and plasticity material(20~80) for hardness of vinyl chloride resin, moving of plasticity material, and bleed. It is possible to use several plasticity materials together.

(0019)

(0019)

The foaming restraint material in the invention is the material which prevent foaming material added to vinyl chloride resin from resolving at resolving temperature. They will be specified by kinds of foaming material.

(0020)

It is no problem to use conventional foaming material now using to vinyl chloride resin interior material as foaming material.; for instance, Asozicalbonamid(ADCA), Zinetolosopentamechilentoramin(DPT), Azobysisoputilonytoril(AIBA), 4 4 Oxybisbenzenehonihilldlazid(OBSH). Also, it is possible to foam adding the kicker, which drops the resolving temperature of foaming material, to vinyl chloride resin. For instance, if foaming material is ADCA, the kicker will be oxide zinc, zinc soap, cadmium soap, iron soap to drop resolving temperature.

(0021)

Foaming restraint material is effective only if you chose proper foaming material. You have to choose proper foaming restraint material, which is effective for preventing kicker and foaming restraint material from raising resolving temperature of foaming material. The foaming restraint material, which prevents kicker function, tries not resolve foaming material until it reaches to its own resolving temperature, and creates foaming part and unfoaming part by the difference of resolving temperature.

(0022)

There are proper foaming restraint materials and foaming restraint efficacy when ADCA as foaming material and DOP as plasticity material are used. It is preferred as the plasticity and the foaming restraint material with good affinity to use solid materials such as benzochiazol, 2-benzochiazolchiall, unwater malainacid, unwater cis A 4 tetorahydoloftaru acid, and requested material such as Asethylatheton. Especially Benzochiazol is preferred because it good at foaming restraint efficacy and moving to DOP. It is good to use foaming restraint material as either a simple substance or a mixture, and also it is no problem to use any kind of foaming restraint material, which has foaming restraint efficacy and affinity for plasticity material.

(0023)

Printing paint, which is liquid and dissolved into solvent of resin or a coloring agent, is used. Adjusting its concentration (5Å`30%) and adding to printing paint uses foaming restrain material. Printing method such as gravure, rotary screen, can print printing to vinyl chloride resin stratum. Heating in an oven at 50Å`150Åé should volatilize the solvent or water of paint after printed. It should be foamed at 150Å`240Åé where foaming material is resolved. If it took too long time, restraint efficacy would drop because foaming restraint material moved too much. It had better to foam in 100hours, especially 24Å`48hours, after printed so that the fall-in-degree of restraint part will be less than 40 degree-slope. The fall-in-degree of restraint part (t) should be 10 to 40 degrees. If less than the degree, printing patterns (2) of concave part (a) will be blur.

(0024)

The vinyl chloride resin in the invention is that adding plasticity material, second plasticity material, stabilizer, filler, viscosity reducer, non-combustion material, foaming material, coloring agent, UV absorbent, oxide prevent material, anti-electricity material, and aiding manufacture material to vinyl chloride resin and blending with monomer such as polymerized mixture of

acetic acid vinyl and vinyl chloride, polymerized mixture of ethylene and vinyl chloride, or heat plasticity material, synthesized rubber to vinyl chloride resin.

(0025)

It is used in the invention that the vinyl chloride resin which is polymerized by alkylbenzenesulfonic acid emulsified to prevent the conflict between foaming stratum and printing pattern at convex part after emboss roll.

(0026)

The printing pattern at convex part would be blur with the vinyl chloride resin polymerized by alkyl sulfuric acid sodium emulsified which is commonly used in chemical embossment. Because the convex part and foaming stratum of chemical embossed convex part even if the fall-in-degree of restraint part was 40 degrees.

(0027)

To solve the conflict, we found out that it is good to use the vinyl chloride resin, which is polymerized by Alkylbenzenesulfonic acid sodium emulsified. It is good to use conventional one and it is preferred to use 500 to 3000 polymerization. It is also preferred to use alkyl-base has 8 to 16 carbons for alkylbenzenesulfonic acid sodium emulsified such as Dodecylbenzenesulfonic acid sodium.

(0028)

The base is not specified for the invention. For instance, it is all right to use the papers, which are added aluminum hydroxide or magnesium hydroxide for incombustible, and fibers such as natural fiber, glass fiber, and chemical fiber. It is preferred to keep the base less than 0.5 mm, and more preferred to keep it 0.05 to 0.2 mm if considered to piling up vinyl chloride resin on it, because if it was too heavy, it would have the problem for combustible as wall or ceiling material.

(0029)

There are two ways to pile vinyl chloride resin up on the base(1). One; painting vinyl chloride resin stratum paste directly on the base (1), heats it at 100 to 170°C less than foaming temperature to be gelled, and piles vinyl chloride resin

stratum up. Two; to pile vinyl chloride resin stratum sheets on the base (1) by adhesive, heating, heat laminating after painting vinyl chloride resin stratum paste to paper patterns, creates the sheet which is gelled, and removed the sheet from the paper.

(0030)

There is the weight limit for the base and vinyl chloride resin stratums for using as wall or ceiling material as fireproof. The vinyl chloride resin stratum should pail up on the base by the weight of less than 400 g/m<sup>2</sup> according to the Nihiru wallpaper 2nd degree fireproof. If the weight of base is 70g/m<sup>2</sup>, the weight of vinyl chloride resin stratum should be less than 330g/m<sup>2</sup>. If the specific gravity of vinyl chloride resin stratum is one to two, the thickness of vinyl chloride resin stratum should be 0.17 to 0.33 mm. The weight and thickness of vinyl chloride resin stratum is determined by capability of fireproof, but would be 0.1 to 0.5 mm in general. There is no limit for length and width, but it is composed as roll by the width of 800 to 1500 mm, and cut it for the size of usage.

(0031)

The foaming rate of vinyl chloride resin stratum should be 1.5 to 6 because if it was lower than the rate, it would be no gap at the uneven patterns of chemical embossment, and if it was higher than the rate, vinyl chloride resin stratum would be spoiled. Foaming restraint material makes vinyl chloride resin stratum foamed except the printing patterns (2) created by paint, and heats its surface soften and melt, then creates uneven crested patterns on the vinyl chloride resin stratum of convex part (b) by emboss roll.

(0032)

Emboss roll is a metal roll, which is 200 to 1000 m diameters and 1 to 2 m widths, and has uneven patterns on the surface. Vinyl chloride resin stratum (3) can get uneven crested patterns (3) on its surface by going through with a base (1) between the metal emboss roll and a rubber roll after it is foamed.

Mechanical embossment is done, and that depends on the gap between the

emboss roll and the rubber roll. It is possible to create a film by applying conventional treatment material about 1 to 30  $\mu$ m on the surface of vinyl chloride resin stratum to have anti-contamination, before or after mechanically created crested patterns (4) by emboss roll.

(0033)

It is preferred to use foaming stabilizer for vinyl chloride resin stratum. It is also preferred to use zinc stabilizers with foaming material, such as calcium-zinc, barium-zinc, potassium-zinc, zinc-sodium-potassium-barium stabilizer, and zinc-calcium-tin. Moreover, it is all right to use the stabilizer with compound to control the strength and size of vinyl chloride resin stratum, and the resolving temperature of foaming material.

(0034)

Here is the explanation of enforcement sample and comparison in the invention. As explained at (0017), mixed foaming restraint to DOP, and examined solubility and moving to DOP. The movement of DOP is examined by gas chromatography or liquid chromatography to check foaming restraint material around the print, which is printed on the surface of vinyl chloride resin stratum by the paint contains foaming restraint material in 10% of its weight, after 24 hour-drying. And determined the movement by checking foaming restraint. But even if the foaming restraint material doesn't dissolve with DOP, if it dissolves other plasticity materials, it can be used as foaming restraint material in the invention.

(0035)

The results of dissolving exams between DOP and foaming restraint materials

Foaming restraint material	solubility	movement
Azibin acid		no
no		
Ftal acid		no
no		

unwater mailen acid	yes		yes
Unwater cisA 4 tetrahydloftal acid	yes		yes
Unwater tirmet acid		no	no
Unwater tetlachloloftal	no		no
Benzotriazol			yes
yes			
2-benzochiazolchiall	yes		yes
Chloride teleftaloir		no	
no			
Acethiaseton			yes
yes			

0036)

We created the vinyl chloride resin paste by combination(1) and combination(2), and applied it, by thickness 0.16 mm, on the base which is fireproof paper (thickness 0.12 mm) with paste cutter, then heated it for 50sec. at 160°C, made it gelled.

(0037)

(Figure !)

combination

PVC (note 1)

PVC (note2)

DOP

Second plasticity material

Stabilizer(Ca-Zn)

Azozicalponamid

Kicker(ZnO)

Filler(CaCo2)

Cell adjuster

Coloring agent

(Note 1) The vinyl chloride resin which his polymerized by dodecibenzenesulfon acid sodium, as emulsified

(Note 2) The vinyl chloride resin which his polymerized by raurium acid sodium, as emulsified.

(0038)

We made gravure printing patterns on the surface of the vinyl chloride resin stratum created by combination(1) and (2) above, by the paint, which was mixed 10 % of its weight of the foaming restraint materials below. After 24 hours, heated it for 60 sec. at 210~~°~~ in an oven, made vinyl chloride resin foamed, and created uneven patterns of chemical embossment.

a. Benzotriazol

b. Unwater trimerit acid

c. Unwater malein acid

d. Unwater cis A 4 tetlahydroftal acid

(0039)

Then, heated the surface of vinyl chloride resin at the foamed convex pattern on the metal emboss roll which was engraved reflection pattern by far infrared rays, and mechanically created crested pattern by a mold. There are the results of exams below.

(0040)

(table 2)

PVC stratum	combination(1)		
Foaming restraint material	a	b	c
d			
Fall-in-degree of restraint part	30	60	25
20			
Chemical concave part			



	break nature(note1)	yes	no
yes	yes		
PVC stratum	combination(2)		
Foaming restraint material	a	b	c
d			
Fall-in-degree of restraint part	35	65	35
25			
Chemical concave part			
	break nature(note1)	no	no
no	no		

(note1) Chemical concave part break nature is: If there is no conflict between foaming stratum and chemical embossment concave printing pattern, and printing pattern is clear, it is YES. If there is conflict and pattern is not clear, it is NO.

(0041)

According to these results, the application of the plasticity material and foaming restraint material which has well combined power creates the slope with less than 40 degrees of fall-in-degree of restraint part. In addition, if it uses the vinyl chloride resin stratum which is polymerized by alkylbenzenesulfonic acid sodium emulsified by compare with the vinyl chloride resin stratum polymerized by alkyl sulfuric acid sodium emulsified, the printing pattern(2) at concave part will be very clear and the molded crested pattern(4) will be sharp as figure 2 shows, but there is no conflict between foaming stratum and printing pattern(2) at concave part(a) by chemical embossment.

(0042)

(Efficacy of the invention)

The interior material in the invention has the unconventional brand-new pattern which is mixed with crested design by mechanical embossment of foaming stratum at convex pattern part and the clear printing pattern by chemical embossment, by using plasticity material and well combination powered material as foaming restrain material, the foaming restrain material moves to the plasticity material, makes fall-in-degree at restraint part by chemical embossment gentle, in addition, by using the vinyl chloride resin stratum polymerized by alkylbenzenesulfon acid sodium emulsifier, there is no interference between the foaming stratum at the convex part and chemical embossment concave part when emboss roll applies, to lose the printing patterns at concave part or to make unclear the bound of concave part and foaming stratum, but to keep printing pattern at concave part clearer.

(0043)

Also, if it uses benzotriazole as foaming restraint material, printing pattern will not make foam, will remain sharp at the chemical embossment concave part, and the foaming restrain material will move to plasticity material properly, so that the fall-in-degree of chemical embossment restraint part will be gentle, and the printing pattern at concave part of interior material will be clearer.

(Explanation of figures)

(Figure1) Explanation of Fall-in-degree at restrained part

(Figure2) Enlarged cross section of enforced example

(Figure3) Enlarged cross section of comparison example

(Explanation of symbol)

1: the base, 2: printing pattern, 3: vinyl chloride resin foaming stratum, a: foaming concave part, b: foaming convex, 4: crested pattern

(Figure1)

**(Figure2)**

**(Figure3)**

**continued from the first page**

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